[JP,2000-147479,A]

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File Wrapper Information

FULL CONTENTS CLAIM + DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1] The color liquid crystal display which uses the microcapsule containing a color and a liquid crystal material.

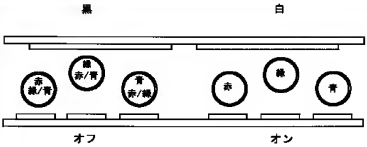
[Claim 2] In a color liquid crystal display according to claim 1, [said color and a liquid crystal material] 1) The microcapsule characterized by being enclosed into the thin wall of a polyurethane, polyurea, or polyurea independent wall, 2 melamine formaldehyde, or urea formaldehyde.

[Claim 3] It is the microcapsule characterized by said liquid crystal consisting of nematic ** smectic A, cholesteric one, ferroelectric materials, and those mixtures in a color liquid crystal display according to claim 1.

[Claim 4] It is the microcapsule characterized by said color including dichroism and/or isotropy, those mixtures, or a pigment in a color liquid crystal display according to claim 1.

[Claim 5] In a color liquid crystal display according to claim 1, [said color] 1) At least two dichroic colors and one

Drawing selection Representative draw



[Translation done.]

isotropic color which form the complementarity black which is enclosed in one capsule, and which is accumulated and boiled, 2 [or] -- at least two dichroic colors which it is encapsulated separately, and these capsules are mixed, and form complementarity black, and one isotropic color -- 3 [or] -- the microcapsule characterized by being formed from what distributed in the binder at least three dichroic colors, one isotropic color, or pigment which forms complementarity black in one capsule.
[Claim 6] In an isotropic color or a pigment according to claim 4, said color is the red, green or the isotropic color characterized by being blue, or pigment of an elementary color.
[Claim 7] The constituent for coating characterized by consisting of a binder of said microcapsule, a surface active agent, water, or a solvent base, or printing.
[Claim 8] 1) Coating to the substrate characterized by consisting of screen-stencil, 2 flexographic printing, 3 offset printing, four photo lithography (photolithography printing), or 5 ink jet printings, or the method of printing.
[Claim 9] a mosaic, a triad, or stripe **** -- the arrangement of printing characterized by things.
[Claim 10] The substrate characterized by consisting of glass, plastics, a metal, or a wafer of silicone in a substrate according to claim 8.
[Claim 11] Equipment characterized by using a black guest host, the color by which microencapsulation was carried out, the mixture of liquid crystal, and a light filter.
[Claim 12] Equipment characterized by using the color formation thing indicated to Claim 5 although a light filter and a guest host liquid crystal display are constituted in a monolayer.
[Claim 13] Equipment characterized by equipping Claim 11 and 12 with a binder, adhesives, and an ITO covering board further in the equipment of a description.
[Claim 14] Equipment characterized by an addressing element containing TFT, TFD, and plasma in equipment according to claim 13.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates not only to a liquid crystal display but to the use of a guest host liquid crystal film which serves as a light filter and by which microencapsulation was carried out, concerning an electrochromatic display labeling display generally. This invention relates also to use of the additive-mixture-of-colors method which generates multicolor-ization of an

output again.
[0002]
[Description of the Prior Art] A color liquid crystal display can be manufactured by the subtractive mixture method which uses the additive-mixture-of-colors method which uses 1 red, green, and a blue nematic curvilinear alignment phase (NCAP) film or cyanogen, magenta, and a yellow NCAP film. These are indicated by U.S. Pat. No. 4,435,047 given to Fergason, No. 4,834,508, No. 4,878,741, No. 4,953,953, No. 5,052,784, No. 5,132,815, and No. 5,142,389. These color liquid crystal displays are manufactured by accumulating a guest host liquid crystal display of three sheets called the cyanogen, magenta, and yellow which were manufactured from the two-layer film general at least, or use 2 subtractive-mixture method. This Papers, such as Trimmier, SPIEVol.1257, Liquid Crystal and Applications (liquid crystal and application) (1990), "Full-Color Subtractive LightValve for Display Applications (full color subtractive mixture light valve for display application)", and 95-103 pages, The paper of Sunohara and others (SUNOHARA), SID 96 Digest, It is described by "A Reflective Color LCD using Three-Layer GH-Mode (the reflection type color LCD using three-layer GH mode)", and 103-106 pages. Another paper of Sunohara and others (SUNOHARA), SID 96 Digest, "Reflective Color Liquid Crystal DisplayComposed of Stacked Films of Encapsulated Liquid Crystal" (reflective color liquid crystal display which consists of laminated films of liquid crystal containing a capsule), The color liquid crystal display by accumulating the guest host liquid crystal layer containing a capsule also on 762-765 pages is described. Or the color liquid crystal display by pasting up a light filter on a TSUISUTEDDO nematic-liquid-crystal display (TN LCD) like what is used for the personal computer of 3 present is described.
[0003] The liquid crystal glob currently indicated by the above-mentioned United States patent given to Fergason or all liquid crystal capsules are prepared by the emulsion method. A Drzaic paper, Journal of Applied Physics, [2142-2148 pages of issue] on Vol.60 and No. September 15, 1986 [6 or] It is reported rather than the liquid crystal by which the NCAP system of the water base prepared from the emulsion method was encapsulated that it is the interpenetration network of liquid crystal within a polymer matrix rather. Therefore, it is difficult to obtain the mixture glob of a color and liquid crystal completely separated in the above-mentioned United States patent given to Fergason. Drzaic paper, SID 92 Digest, "31.1 invitation lecture : [Dichroic-Based Displays from Nematic Dispersion(display of dichroic base from nematic dispersion)"571-574 page]

Mixing of the black dichroism color mixture to a NCAP film is [that the polarizer for improving optical efficiency can be lost, and] full color NCAP. It is said that LCD can be manufactured when a light filter pastes up. The fault of this method is the stability problem of the dichroic color in this system. The cyanogen of three sheets, magenta, and the color liquid crystal display manufactured by accumulating the guest host LCD of yellow generate high luminance. However, the light transmittance state decreases and the production cost is expensive as an object for commerce for high production. TN Since incident light is greatly absorbed with a polarizer and a light filter, the color LCD prepared by adhesion of the light filter to LCD has low optical efficiency. TN In order to obtain sufficient luminance as LCD, it is required to use the transparent mode by backlight. As a result, a heavy battery is needed and the short life of a battery is unsuitable to practical portable equipment.
[0004]
[Problem to be solved by the invention] In order to simplify the manufacture process of a display, to reduce manufacture cost and to reduce power consumption, multicolor LCD of the lamina which does not use a light filter and a polarizer is desired. Papers, such as Wu, SID 90 Digest, "Miniature Color Liquid Crystal Display (small color liquid crystal display)", It is stated to 217-219 pages that it can manufacture when the guest host polymer distributed liquid crystal display (PDLC) of a lamina dissolves the dichroic color of an elementary color into liquid crystal of three groups who have different character (for example, permittivity, birefringence, a double frequency). Since the color liquid crystal display of a lamina is constituted, the thing of use of liquid crystal which has double frequency nature is stated to U.S. Pat. No. 5,132,815 given to Fergason. The above-mentioned lamina display is using the phase separation method and the emulsion method, respectively. The mixture glob of a color and liquid crystal obtained as a result of being prepared by these two methods has the separated color, the color which differs rather than the glob of liquid crystal, and the tendency which forms the mixture glob of liquid crystal. The glob of each color and liquid crystal mixed in order to use it for the lamina color LCD is the separated capsule, and should fully be protected by the capsule wall. Thus, these can be used in order to manufacture the practical lamina color LCD.
[0005] The United States patent application 08th of two affairs for which Hsu applied / No. 827,579, the 09th / No. 042 or 394 are included in this application as reference. This has described the thing of the liquid crystal (MLC) material which carried out the form of the individual liquid crystal capsule containing a dichroic color, isotropic colors, or these

mixtures and by which microencapsulation was carried out. If the capsule of the mixture of these different colors and liquid crystal is mixed by the binder, even if these carry out churning mixing, they are stable. Furthermore, it is improved dramatically and the stability of the color in a capsule comes to be suitable for a practical use.

[0006]

[Means for solving problem] or [that this invention includes the color by which microencapsulation was carried out, the mixture of liquid crystal, and an isotropic color or a pigment] -- or it is related with the color liquid crystal display which uses the distributed binder which is not included. The mixture of this color and liquid crystal can be formed by a dichroic color, liquid crystal, a dichroic color, an isotropic color and liquid crystal, or an isotropic color and liquid crystal. In other viewpoints, this invention relates also to the multicolor generation by the color element of the complementary color which used the additive-mixture-of-colors method. Furthermore, in other viewpoints, this invention relates to the production method of the multicolor liquid crystal display of a lamina. In addition, in other still more nearly another viewpoints, this invention has stated how to manufacture a color liquid crystal display by the method of coating and printing.

[0007]

[Mode for carrying out the invention] The microcapsule containing the liquid crystal used by preparation this invention of the liquid crystal (MLC) by which microencapsulation was carried out, and a color is prepared according to the method indicated by the United States patent application 08th / No. 827,579, the 09th / No. 042 or 394. According to this invention, it can ** preparing MLC material according to polyurethane and interfacial polymerization which forms one thin capsule wall of polyurea, polyurea, melamine formaldehyde, and urea formaldehyde which encloses the glob of dispersed color/ liquid crystal. The homogeneous solution of a color, liquid crystal, and a polyisocyanate is prepared. A water emulsification solution is put in by the long head beaker, and is held in a 50-degree C water bath (hot bath). The solution of a polyisocyanate, a color, and liquid crystal is added to a water emulsification solution, agitating violently until desired liquid crystal glob size (2-3 microns) is obtained. And churning velocity is reduced and a reaction is continued at 50 degrees C for 8 to 10 hours. A polyol and/or polyamine, and a catalyst are added during this reaction. At the time of termination of a polymerization, it is water NH4 in order to carry out postcure of the activity remains-NCO group. OH solution is added. The slurry obtained as a result is purified by the centrifuge, in order to remove a

superfluous reactant and a superfluous emulsifier and to obtain a pure liquid crystal microcapsule wet cake. A capsule wall is made from polyurethane / polyurea, or polyurea.

[0008] The method of other microencapsulation is making the aqueous solution of an ethylene maleic anhydride (EMA) copolymer (copolymer) emulsify the mixture of a dichroic color and liquid crystal. This emulsifier is prepared by dissolving an EMA copolymer in the water of a warm temperature, and that pH is adjusted to 4-5 by adding a NaOH solution. This microencapsulation is performed by generating the thin melamine formaldehyde film which adds 30% of Cymel 372 aqueous solution, and surround a liquid crystal glob at the temperature of 60-90 degrees C. The formed liquid crystal glob is purified by the centrifugal separator in order to form a wet cake.

[0009] Drawing 1 is the figure of the suitable color liquid crystal display of this invention which uses three liquid crystal (PDMLC) material which includes two dichroic colors, the color of one isotropic red, green, and blue, or a pigment, respectively, and by which black polymer dispersion microencapsulation was carried out. These form a complementary color mixture and are separately coated on three subpixel. Three liquid crystal (MLC) material which is used for the lamina color liquid crystal display shown in drawing 1 and by which black microencapsulation was carried out is manufactured according to the following combination. : Black dichroism / isotropy MLC Color of ON state A dichroic color Isotropic color Green/blue Red Red Red/blue Green Green Red/green Blue Blue [0010] = Drawing 2 is the figure of the color liquid crystal display with suitable this invention which uses three mixtures with the binder containing the pigment or color of black PDMLC which includes a dichroic color in three capsules, isotropic red, green, and blue, respectively. A lamina color liquid crystal display can also be manufactured according to the following process from three combination of a black dichroism MLC capsule and the capsule of three isotropic red, green, and blue. The structure of this color LCD is shown in drawing 2 .

Black dichroism MLC An isotropic color Color of ON state Red / green / blue Red Red Red / green / blue Green Green Red / green / blue Blue Blue [0011] = Although it can be directly dissolved by an elementary color isotropy color or the pigment into a binder or it can be distributed, it is mixed with black guest host MLC material after that, and these binders form electrochromatic display printing ink. The structure of this color LCD is shown in drawing 3 . Drawing 3 is a figure of the suitable color liquid crystal display of

this invention which uses three mixtures of black PDMLC containing a dichroic color and the binder with which the pigment or color of isotropic red, green, and blue is distributed, respectively. Such PDMLC material is separately coated on three subpixel.

[0012] The capsule cake of the mixture of the purified color and liquid crystal after fully mixing to the preparation binder and surface active agent of a polymer dispersion MLC (PDMLC) film can be coated or printed on an indium tin oxide (ITO) covering board. And although the layer of the optical adhesives of ultraviolet curing nature is coated on a guest host PDMLC film, this is laminated by another ITO covering board after that, and forms a PDMLC display. This color liquid crystal display can be manufactured by pasting up a light filter on this PDMLC film. If a trichromatic MLC material is separately printed on an ITO board as one mosaic, two stripes, or subpixel that is 3 triad (3 groups) arrangement, it can manufacture the display which combines the light filter and guest host liquid crystal of a lamina.

[0013] Now, if drawing 1 is referred to, the multicolor liquid crystal display 1 of this invention consists of a glass substrate 2 which has common ITO3 and pixel ITO4, and a layer of the black guest host (GH) PDMLC material 5 distributed in the binder 6 fundamentally. The black microcapsule in this PDMLC film consists of the capsule wall 7, liquid crystal 8, two dichroic colors 9, and one isotropic color 10. In OFF state, the orientation of liquid crystal 8 and the color molecules 9 and 10 in this capsule is carried out at random, and this scatters about for it and absorbs incident light. Since light and a color output do not exist, the appearance of this display becomes black. Liquid crystal and the dichroic color molecule in a capsule have aligned in parallel with the impressed electric field, and only an isotropic color expresses the color with ON state. A display looks white when all three subpixel is turned on.

[0014] If drawing 2 is referred to shortly, other multicolor liquid crystal displays of this invention consist of binders 6 containing the black GH-PDMLC capsule 5 and the isotropic color capsule 11. By OFF state, this display shows black appearance. When one of the red subpixel is turned on, liquid crystal 8 and the dichroic color 9 align in parallel with the impressed electric field, and only the isotropic red color 10 expresses the red corresponding to this. Similarly, by drawing 3 , when red and green subpixel are set to ON, the place which a green color 10 or a green pigment 10 is distributing in a binder 6 looks green.

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